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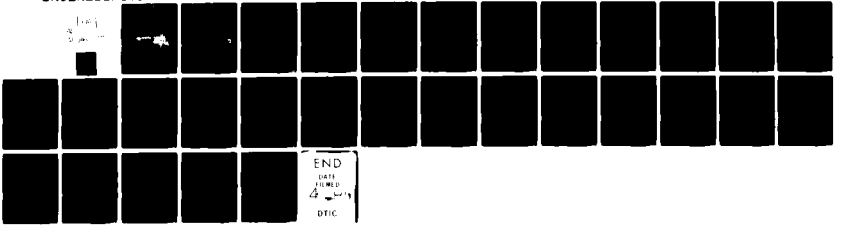

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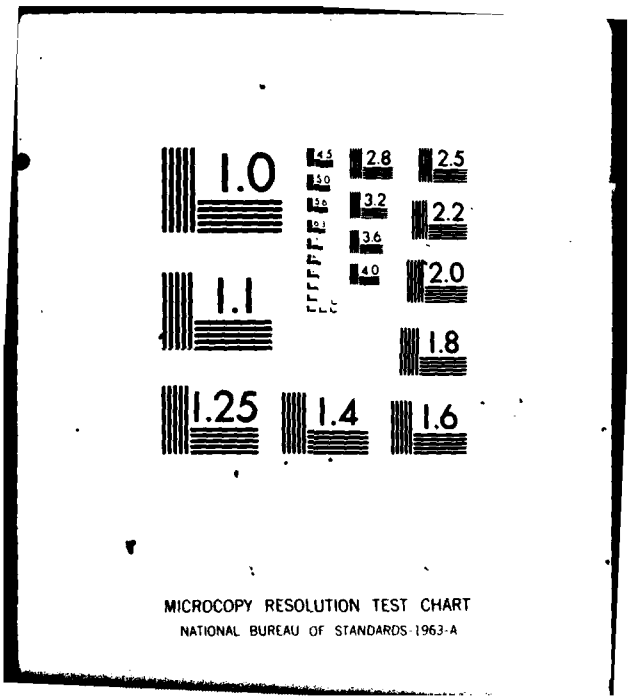
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ENVIRONMENTAL AND CULTURAL IMPACT

PROPOSED TENNESSEE COLONY RESERVOIR

JAN. 1972

TRINITY RIVER, TEXAS

by

STEPHEN F. AUSTIN STATE UNIVERSITY

Nacogdoches, Texas

BOTANY
ZOOLOGY
GEOLOGY

EUTROPHICATION
PESTICIDES
HYDROLOGY

LAND USE
HISTORY
ARCHAEOLOGY

VOLUME I
SUMMARY REPORT

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This is an interim report of the study concerned with environmental and cultural impacts of the proposed channelization of the Trinity River. This publication presents data concerning the environmental impact of the proposed Tennessee Colony Reservoir. This interim report consists of five volumes: volume one contains the summary report; volume two contains archaeological and historical elements, geological elements, and botanical elements; volume three contains zoological elements and eutrophication and pesticide elements; volume four contains forest hydrological and soil conditions for watershed

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20. management; and, volume five contains conceptual land use elements.

ENVIRONMENTAL AND CULTURAL IMPACT OF THE PROPOSED TENNESSEE COLONY RESERVOIR

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Fort Worth, Texas
31 January, 1972

FORWARD

The deep-seated impact of man's activity on his environment has received much attention in the past few years. Recognition of the importance of restoring and maintaining environmental quality was acknowledged by Congress when they enacted the National Environment Policy Act of 1969. As a result of this concern, environmental impact studies must be carried out to determine if losses outweigh gains in regard to proposed projects. This publication presents data concerning the environmental impact of the proposed Tennessee Colony Reservoir, which if created will be located on the Trinity River near Palestine, Texas. It is not concerned with decision-making as to whether the Tennessee Colony Reservoir should or should not be constructed, but it is hoped that this report will aid the public and interested organizations in arriving at a decision which will be of most benefit to man and his environment. The study team acknowledges that it would have been more desirable to gather data over a period of one to two years, rather than the relatively short period of five months which was alloted.

ACKNOWLEDGEMENTS

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Personnel of many agencies provided assistance to the project for which grateful appreciation is given. Agencies involved included the Engeling Wildlife Management Area, Texas Highway Department, Palestine Chamber of Commerce, Malakoff Chamber of Commerce, Carnegie Library of Palestine, Palestine Historical Survey Committee, Texas Water

Development Board, Soil Conservation Service, Texas Forest Service, Texas Parks and Wildlife Department, Sierra Club, The Trinity River Authority of Texas, and the management of the Big Brown Steam Electric Station. The Houston Planning firm of Marmon, Monk and Green, Inc. made valuable suggestions on map reproduction.

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Others who deserve recognition for service to the project are Dr. Charles W. Mims, Dr. Don Anderson, Dr. Carey Crocker, Mr. Volker Göbel, Dr. Jerry Vincent, Mr. Byron Vandover, Mr. K. C. Rudy, Mr. Joe Dawson, Miss Martha Cooper, Miss Donna Turner, Mr. Tom Middlebrook, Mr. Robert Sniffen and Mr. Michael Butts.

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INTRODUCTION

The U. S. Army Corps of Engineers has proposed to channelize the Trinity River from Fort Worth, Texas to the headwaters of Lake Livingston and to establish a reservoir on the Trinity River northwest of Palestine, Texas. This proposed reservoir would be called Tennessee Colony Lake and occupy approximately 98,000 acres at conservation pool level and 147,200 acres at the flood control pool level.

In order to determine the environmental and cultural impact of channelization of the Trinity River and of the Tennessee Colony Reservoir, the Corps of Engineers requested that a survey of archaeological, historical, geological, botanical, zoological, forest hydrological, eutrophication and pesticide elements be made. An interdisciplinary research team from Stephen F. Austin State University was awarded a grant from the Corps of Engineers to accomplish this survey.

The study was divided into two phases. The first phase includes an in-depth study of the Tennessee Colony area. This facet of the survey began on 1 September, 1971 and is presented here as an interim report. The second phase will include a survey of the Trinity River from Fort

Worth to Lake Livingston with the objective of providing focal points for future in-depth studies.

The Trinity River basin, bordered by the Neches River basin to the east and the Brazos and San Jacinto River basins to the west and south, comprises an area of approximately 18,000 square miles. From its origin in Archer County, the basin extends some 350 miles to Trinity Bay near Anahuac, Texas. The site for the proposed Tennessee Colony Reservoir is about half-way between the point of origin of the Trinity River and its termination at Trinity Bay. The larger communities in the area of the reservoir include the cities of Palestine, Malakoff and Athens, which border the reservoir to the east, and the cities of Fairfield, Kerens and Corsicana which border to the west. The reservoir would be located within portions of Anderson, Henderson, Freestone and Navarro Counties.

The Tennessee Colony area is within the Coastal Plain physiographic province. The topography in the immediate lake area is flat to gently rolling and hilly. Geologically, the reservoir would cover strata of Mesozoic and Cenozoic age. The sedimentary strata consists mostly of sandstones, siltstones, and shale interbedded with less consolidated clay, silt, and sand.

Biologically, the Tennessee Colony site lies in a transition between the Texan and Austroriparian biotic

provinces. These provinces are distinquished on the basis of climate, physiography and soil. The bottomland fauna and flora dealt with in this study are more characteristic of the Austroriparian biotic province. The Tennessee Colony region is transected by two vegetational areas. The Post Oak Savannah area, which is characterized by hardwood trees and sandy soils, extends over most of the reservoir site, and the Blackland Prairie vegetational area mantles the northern portion. Much of the bottomland vegetation in the lake area is characteristic of the river-bottoms of east and southeast Texas and, therefore, is representative of the bottomland sites of the Pineywoods vegetational area.

Two principal tributaries of the Trinity River, Cedar and Richland creeks, are located within the proposed Tennessee Colony Reservoir area. It should be noted, however, that water flow into the Trinity River by way of Cedar Creek is regulated by Cedar Creek Reservoir. Many other creeks enter the Trinity River within the confines of the proposed project with Rush and Tehuacana Creeks being the more significant.

METHODS

An environmental and cultural investigation of archaeological, historical, geological, botanical, zoological, eutrophication, pesticide, forest hydrological and conceptual land-use elements located in and around the site was conducted from 1 September, 1971 until 31 January, 1972. Data were collected in the field and from available maps and aerial photographs. Additional information was gathered from conversations with local, state and federal representatives of various organizations, and from talking with citizens living in the project area. Finally, a review of available literature was conducted.

Historical and archaeological elements were surveyed by obtaining lists of historical sites from each county historical society and historical survey committee. Personal communications with local inhabitants also aided greatly in the location of historical and archaeological sites. After sites were located, each was visited and an estimate of its importance was made.

The geological elements considered were land forms, rock and mineral features, paleontological items, faults, and other structural features, and scientifically or uniquely important geological areas within or adjacent to the proposed project area. Other geologically related pheno-

mena and of potential importance such as caves and strip-mined areas, were also considered, as were possible geological changes following impoundment (e. g. erosion, sedimentation, position of the water table and artificial recharge). Aerial surveys were carried out and maps and aerial photographs were used to locate important geological phenomena and to delineate areas requiring more detailed investigation.

Plant communities in and around the proposed Tennessee Colony Reservoir were examined in regard to size, location, description, content, and significance of content. Within each community, estimates of abundance were made for shrub and tree species present. In addition, checklists were prepared for herbaceous and woody vascular plant species. Impact of the proposed Tennessee Colony Reservoir on the vegetation was considered and conclusions and recommendations were made.

Surveys of the terrestrial and aquatic vertebrates, and of benthic macroinvertebrates in the Tennessee Colony area were made by field observations and trapping or collecting. Emphasis was placed on species inhabiting aquatic and riparian environments, on important game animals, and on rare, endangered or endemic species. Particular attention was focused on probable changes in populations following the construction of the reservoir.

Eutrophication and pesticide data were gathered by ground and aerial surveys, laboratory and field studies, and by reference to publications from state and federal agencies. These were used to evaluate the present eutrophic condition of the Trinity River; to assess the present application of pesticides in the counties surrounding the proposed Tennessee Colony Impoundment; and to estimate the degree of pollution by pesticides in the river waters. Having established these points, predictions were made as to the possible impact of channelization and construction of an impoundment on the aquatic environment.

To assess the environmental impact of the proposed project, an inventory was made, via reconnaisance methods, of existing forest hydrological and soil conditions. Soil studies were conducted to determine moisture carrying capacity and hydrological potential of the immediate project area. Hydrological changes that might result from the proposed project were identified, including ground water recharge shifts. Hydrological effects on the flora and fauna were also considered.

A concept land use plan was developed for the study area from soil capability classes, topographic maps, aerial photographs, and field inspections. All land uses were field checked in areas of environmental impact.

Following completion of field investigations, each member of the study team prepared an in-depth report, setting forth specific conclusions and recommendations in regard to the environmental impact of the proposed project.

FINDINGS

The following findings are summarized from the in-depth reports of the investigating teams, which are included in Appendices A through G.

1. The area to be inundated by a dam at site 2A on the Trinity River includes a great deal of good ranch land and an estimated 30,000 - 35,000 acres of bottomland hardwood forest. Also included are several producing oil fields and some sand and gravel beds. The wells furnishing the water supply for the city of Trinidad and wells for several industrial operations will be submerged. Several fossil localities along the cliffs of the Trinity River northeast of Kerens will also be flooded.

2. Noteworthy ecological areas which will be inundated include: (a) Indian and Rush creeks, where several potential state champion trees occur; (b) upper Richland Creek, which is characterized by some large trees; (c) a large forested area along the Trinity River in the vicinity of horseshoe bend and Twin Lakes, between highways 85 and 31; (d) a relatively undisturbed belt of woodland on the east side of the river about one mile south of highway 31; and (e) an extensive forested area with some large trees south of Stephens Lake between highways 31 and 287.

3. The flora and fauna of the Tennessee Colony area are, in general, similar to that of the southeastern United States. There are approximately 20-25 species of herbaceous plants and one woody plant which are either rare or are endemic to Texas, including the grass-pink orchid, which is known only from Henderson County. Rare or endangered birds known to occur in the area are the Bald Eagle and the Osprey, both found in small numbers during the fall, winter, and spring. In addition, the Peregrine Falcon probably migrates through the area. No mammals, herps, or fishes presently considered rare or endangered are known to inhabit the specific area of the proposed project. Beavers are probably more abundant here than anywhere else in Texas.

4. Flooding of bottomland hardwood forests will cause a decline in many vertebrate species, including such popular game animals as the white-tailed deer and gray and fox squirrels. Many floral elements which have already been greatly reduced in numbers will also be destroyed. When viewed in overall perspective of the total east Texas region, these losses may not seem very significant, yet the rate at which floodplain forests are disappearing is cause for alarm if a balanced natural ecosystem is to be maintained.

5. The proposed reservoir, if created, would give

rise to a potential sport and commercial fishery, although current oxygen, toxicity, and turbidity levels in the Trinity River are critical and would restrict a healthy warm water fishery. Waterfowl populations would probably also increase, but there is considerable danger from pesticide and oil pollution, and disturbance effects of proposed barge traffic would reduce the potential of the reservoir as a suitable environment for waterfowl and other wildlife.

6. There is a low diversity of benthic macroinvertebrates in tributaries of the Trinity River, probably due to an unsuitable scoured substrate. Benthic fauna are typically pool or lake types, rather than typical stream organisms, because the streams lack riffle areas and are intermittent. Populations of some benthic forms may be enhanced by the creation of the proposed impoundment, but poor water quality of the Trinity River could restrict their abundance.

7. To the extent that the proposed reservoir will control downstream flooding, the flora and fauna of the floodplain below the dam will be adversely affected by the drying up of the marshes, sloughs, and swamps. Forests adapted to periodic inundation could eventually be eliminated, and with them their associated bottomland faunas.

8. The change in soil hydrology around the shore of the new reservoir will have certain predictable effects

(a) fluctuations in the water table will depend on interrelationships between precipitation and reservoir level, (b) excessive water in or on the soil will interfere with plant growth, tree reproduction, and occasionally with cultivation of row crops, (c) upland hardwoods may be replaced in some areas by tree species common in transition areas and in some of the bottoms, (d) understory vegetation in some wooded areas will increase, thereby increasing wildlife habitat, (e) farming will be restricted to drier periods of the year, (f) a medium risk of erosion will be present unless close-growing plant cover is maintained, (g) residential and industrial development will be hampered, and (h) there will be a danger of pollution from unchecked sewage disposal infiltrating into the ground water, and from surface water runoff carrying fertilizers applied to adjacent pastures.

9. Nutrient levels in the Trinity River, such as those of nitrate-nitrogen and orthophosphates, and very high populations of phytoplankton and periphyton, indicate excessive eutrophic conditions. Rates of primary production are comparatively high. The species of algae in the phytoplankton and periphyton are those commonly associated with organic pollution, and the high numbers for total coliform bacteria suggest that sewage effluent is the primary source of organic pollution. Diversity

index values indicate periodic heavy pollution near the NIPAC fertilizer plant outfall. The upper portion of the proposed reservoir will probably be the most critical region from a eutrophication standpoint, because of increased water transparency and high nutrient levels.

10. Estimates of insecticide and herbicide usage are high for some counties in the Tennessee Colony area, such as Navarro County, but pesticide levels in the river appear to be suitably low.

11. Prolonged thermal stratification and water release from the hypolimnion of the proposed reservoir could cause nutrient enrichment and low dissolved oxygen values downstream. However, this problem will probably be minimal because the reservoir morphometry and wind action may not allow the reservoir to stratify for extended periods.

12. Inundation of several existing oil fields will result in loss of income and will create a serious potential threat of pollution by oil and oil field brines. If the fields are to continue to operate, oil-pumping and storage stations and oil and gas pipelines must be either elevated above the future reservoir level, relocated out of the lake area, or abandoned. Elevation of well sites would be aesthetically displeasing and would if located in the traffic pattern, constitute a hazard to proposed

navigation. Perhaps some of the undesirable channel excavation materials could be used for the elevation of the well sites, but relocation of the facilities would appear to be the best solution.

13. Oil field brines are commonly retained by present practice in unlined pools or are discharged onto the ground and into creeks. Contamination of the reservoir by these brines would result in a considerable increase in water salinity, with the denser saline water forming a lower water layer. Anaerobic, toxic conditions would be created, and an increase in flocculation and sedimentation of clay minerals would also occur. Water quality would also decrease, making water purification more costly.

14. Flooding of sand and gravel production areas will result in the loss of a valuable source of construction materials and income. Potential clay deposits in the Tennessee Colony area will probably not be adversely affected by the proposed reservoir. Rather, lower shipping costs will possibly encourage greater development of these deposits.

15. The flooding of fossil localities along the cliffs of the Trinity River northeast of Kerens is not considered to be significant. They are sparingly fossiliferous and contain mostly microfossils which can be

found elsewhere. One locality is possibly significant because it is the only outcrop to yield the foraminifera Cornuspira carinata.

16. The flooding of the type of locality of the Kerens member of the Wills Point Formation east of Kerens will not be an important loss. The locality has been adequately described, and a new, satisfactory alternate could probably be located.

17. The discharge of sediments by tributaries into the shallow water subbasins of the reservoir will cause their progressive silting-up, which is also promoted by the possible increased salinity of the lake water.

18. The strip-mining of lignite north of Fairfield for use as fuel to generate electric power in the Big Brown power plant northeast of Fairfield poses a potential pollution problem. These lignites contain sulfur and perhaps mercury compounds. Apparently, neither sulfur dioxide gas nor mercury vapor if present will be removed from the stack emissions of the power plant. Dispersal of these gases by the wind would have adverse effects in downwind areas, including the reservoir and its drainage areas. An increase in the acidity of surface waters is also a possibility.

19. Aquifers occur in the major part of the Tennessee Colony area. The initial effect of the impoundment

on these aquifers will be the reversal of the water table slope away from the reservoir. This reversal coupled with artificial recharge from the reservoir results in an increase in the water level in adjacent aquifers. Seepage and ponding is most likely to occur in the areas of Catfish Creek and the city of Trinidad.

20. Peat deposits of potential economic value will be inundated by the reservoir.

21. No major historical or archaeological sites will be inundated by the proposed reservoir. However, an area between Cedar Creek Reservoir and the Trinity River (near Trinidad), and an area near Daniel Lake in Navarro County, will need to be gone over carefully for Indian artifacts before being covered with water. The Winn Cemetery at Yard should be moved.

RECOMMENDATIONS

The following recommendations are summarized from the in-depth reports of the investigating teams, which are included in Appendices A through G.

1. If the proposed project is carried out, dam site 2A is recommended in preference to all other proposed sites, in order to protect the unique flora and fauna associated with the Beaver, Catfish, and Keechie creek areas.

2. Long-term succesional studies of the vegetation should be initiated along the shoreline of the new reservoir and on floodplain areas below the dam. Bottomland hardwood forests remaining along the shores of the reservoir should be set aside for protection of the flora and fauna. In order to preserve the flora and fauna of existing marshes, sloughs, and swamps in the floodplain below the reservoir, the river should be periodically diverted, in a controlled manner, through these areas.

3. A detailed watershed conservation plan should be done on all areas immediately adjacent to the reservoir. Some components of the investigation would be forest communities, land use, land ownership, pasture and crop location, forested filter strips, and green tree reservoirs

for wildlife. Land management programs of the federal and state governments should focus on conservation areas, the choice of conservation practices resting with the individual landowners.

4. A preimpoundment survey of fishes in the Trinity River and its tributaries should be conducted to identify potential fishery management problems.

5. The proposed reservoir should be closely monitored for: (a) excessive standing crops of algae and aquatic vascular plants, (b) pesticide levels, (c) oil field brines and other chemical pollution, such as the waste discharges of NIPAC fertilizer plant, and (d) rate of silting. Pesticide surveys should include sediment analysis as well as water analysis.

6. Facilities for treatment of domestic and industrial sewage upstream should be continuously improved to reduce eutrophic conditions in the reservoir. A follow-up study should be done subsequent to the construction of the impoundment to compare eutrophic conditions in the reservoir and river with pre-impoundment data. The installations of septic tanks and cesspools adjacent to the proposed reservoir should be controlled so that they do not become a pollution problem.

7. Eutrophic conditions should be reduced below the reservoir by nutrient and silt removal in the impoundment.

8. Potential oil and oil field brine pollution can be avoided through careful production, storage, transport and disposal practices in compliance with state and federal regulations. The practice of pumping waste disposal into deep disposal wells should be adhered to. Provisions should be made for frequent monitoring of creeks draining the oil fields to insure that this practice is carried out.

9. Frequent monitoring of the air and soil in a downwind direction from the Big Brown power plant should be conducted to insure that acid and mercury pollution are at a minimum. Creeks draining the lignite strip-mining area should also be monitored for acid pollution. The potential hazards involved in burning lignite can be overcome by the installation of adequate removal equipment in the emission system of the plant.

10. Disposal of large amounts of channel-cut material in excess of that required for construction fill may be accomplished by using the material for roads and highways, rehabilitations of blighted areas caused by gravel and clay pits, and possibly for elevating oil field facilities in the project area.

ENVIRONMENTAL IMPACT ANALYSIS

1. Environmental impact of the proposed project

The project will create a reservoir approximately 40 miles long with a flood pool surface area of about 150,000 acres. Much valuable ranch land, an estimated 30,000 - 35,000 acres of bottomland forest of varying quality, and many sloughs, swamps, and marshes will be flooded. Several oil fields of economic importance, some sand and gravel production areas, and part of Coffield State Prison Farm will also be inundated. It is anticipated that organic pollution, which is presently at a very high level in the Trinity River, will continue to be a severe problem in the proposed reservoir. There is also potential danger from pesticides, industrial wastes, and oil field brines.

Elimination of bottomland forest habitats will result in the loss of a diverse flora and fauna which is already declining in east Texas. In addition to the scientific, ecologic, and aesthetic value of these populations, some species are of economic value as game animals, the most important of which is the white-tailed deer. Even without the proposed project, however, these communities might not persist, since presently many of the

floodplain forests are being cleared by landowners to create new pastures and farmland.

To the extent that the project will reduce or eliminate flooding downstream from the dam, it will bring about changes adverse to both terrestrial and aquatic animal populations. These changes could include elimination of floodplain pools and mesic plant communities.

The impact on the environment will not all be detrimental. Recreational potential of the area for such activities as swimming, boating, camping, and water skiing will be enhanced, assuming satisfactory water quality can be maintained. Within limits posed by oxygen, toxicity, and turbidity levels, the reservoir will provide a potential sport fishery, and waterfowl populations may well benefit. A raising of the water level in aquifers will increase the availability of groundwater for municipal and industrial use.

2. Adverse environmental effects which cannot be avoided should the project be implemented

The loss of important ecological areas and their populations of game animals cannot be avoided, and mitigation in terms of wildlife loss is not considered possible. From an economic viewpoint the most serious un-

avoidable effects of the proposed project will be the reduction in numbers of deer and squirrels, and the inundation of oil fields, gravel pits, and fertile farmland. Although the ecological areas to be destroyed at the Tennessee Colony site may not seem significant when viewed as part of the whole Trinity River watershed or the total east Texas region, their loss is nevertheless another link in a long chain of events which if continued will result in extinction of certain floodplain communities, the consequences of which cannot yet be predicted except qualitatively in terms of their aesthetic value.

3. Alternatives to the proposed action

The primary purposes of the project are to control flooding in the Trinity River watershed and, as part of a long-range plan, to provide a waterway linking the Dallas-Fort Worth area to Houston and the Gulf of Mexico. No alternatives to flood control are presented, though it should be pointed out that the present fertility of the Trinity River floodplain is a result principally of centuries of periodic inundation by flood waters of the river, and that if flood control is successful the natural fertility of the floodplain below the reservoir can be expected to decrease. It is suggested that existing or new railway facilities are an alternative means of transportation which would have significantly less adverse environmental impact than the proposed project.

4. Relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity

Short-term and long-range harmful effects of the project have already been identified. Benefits derived from the reservoir will depend largely on how successfully water quality can be maintained over a long period of time. The present trend of events in similar projects already completed does not stimulate very much optimism. From the standpoint of natural communities of plants and animals, the long-term impact will be more detrimental than beneficial. Whether or not recreational uses of the reservoir will compensate for the ecological and aesthetic losses of floral and faunal elements is questionable. The increased acreage available for agriculture downstream from the project, resulting from flood control, will be economically important only to a relatively few landowners. Considerably more quantitative data assigning economic value to aesthetic, scientific, and ecologic qualities of the environment are necessary to arrive at a balanced overall impact statement of long-term effects.

5. Irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented

Several sand and gravel production areas, and peat deposits of questionable value will be submerged and irretrievably lost. Oil field of economic value will be inundated, thereby hampering production, and some 35,000 acres of dwindling wildlife habitat will be irreversibly destroyed. No significant historical or archaeological sites will be lost.